JP-09259200A

Character Reader

[Abstract]

[Problems to be Solved]

This is a device for verifying characters read by an OCR or a scanner. The device aims to facilitate the verification of a document and its read characters by generating on a display screen in arrangement similar to character array on the document by a document analyzing means.

[Solution]

The result of recognition is displayed on a display 2 in a layout similar to a corresponding document by applying both a character position calculating means 26 and a document analyzing means 28 to information about a character position on the document and a character size that are stored in a character position information storing means 24 and a character size storing means 25, respectively.

[What is claimed is:]

1. A character reader, comprising:

a character recognition means for recognizing characters on a document;

a character position inputting means for through which an operator inputs document design or measurement values indicating the position of a character on a document or an automatic character position detecting means automatically detecting a character position on the document and a character size in order to omit measurement or input work;

a character position information storing means for storing character positions on a document;

a character size storing means for storing character sizes on a document; and

display means for outputting characters of a recognized field on a display screen in arrangement similar to character array on a document without dividing the characters into a plurality of display screens, using information about both positions on a document of characters to be recognized and their sizes.

2. A character reader, comprising

means for generating a display screen with arrangement similar to character array on a document without reducing sizes of characters to be displayed when one document cannot be accommodated in one display screen in the verification display of a read result.

3. A character reader, comprising.

means for predicting related fields from its

layout and displaying the related fields as much as possible on one display screen, and displaying contents of the fields so that the fields may not be divided among a plurality of screens when one document is displayed across a plurality of display screens in the verification display of a read result.

4. A character reader, comprising

means for displaying contents of related windows as much as possible on one display screen without changing sizes of characters belonging to a field so that the fields may not be divided among a plurality of screens even if a display range or a size of a window to be displayed of a display screen is modified in the verification display of a read result.

[Preferred Embodiments]

[0010]

However, the device of the present invention comprises a character display position calculating means 26 and a character display position calculating unit 27, both calculating display position information used to display characters on a display screen in a layout similar to a document, a document analyzing means 28 calculating a boundary used to divide a document to generate a display screen easy to see and easy to check

a field since the contents of related fields are displayed easy to see on one screen so that the fields may not be divided among a plurality of screens even if scrolling is conducted when a document cannot be displayed on one display screen and is displayed across a plurality of screens, a boundary position determining unit 29 determining an optimal boundary used to divide a document that is calculated based on a display position calculated by the character display position calculation unit 27, using both the document analyzing means 28 grouping fields and a display position information storing unit 30 storing information for displaying characters on a display screen.

[0011]

The character display position calculating unit 27 calculates the display position on a display screen of each character of a document according to information outputted by both the character position information storing unit 24 and character size storing unit 25, using the character display position calculation unit 26. Then, the boundary position determining unit 29 determines whether all the display positions can be accommodated in one display screen or whether related fields can be displayed on the same display screen, using the document analyzing unit 28. If the determination is yes, the

display positions are stored in the display position information storing unit 30. If the determination is no, the character display position calculating unit 27 re-calculates the display position on a display screen of each character in a document using both the document analyzing means 28 and character display position calculating means 26, and then the above-described operation is repeated until the determination of the boundary position determining unit 29 becomes yes.

[0012]

Next, the document analyzing unit 28 is described. The document analyzing unit 28 comprises a field grouping means 21 grouping fields utilizing the features of a layout and calculating a boundary used to divide a document. Fig. 2 shows one method for calculating the position of a field.

Next, both the seven conditions of the field grouping means 21 used to group fields, and the rules on the movement of a boundary are described.

[0013]

The first condition is that if "the number of fields, in which the x-coordinates at the rear end are the same, is large, all fields located on the left side of the x-coordinate at the rear end of the field should belong to the same group".

[0014]

The second condition is that "if the number of fields, in which the x-coordinates at the front end are the same, is large, all fields located on the right side of the x-coordinate at the rear end of the field should belong to the same group".

[0015]

The third condition is that "fields, in which the x-coordinates at the front and rear ends are the same, should belong to the same group".

[0016]

The fourth condition is that "of fields belonging to the same group that are calculated on the third condition, all fields, in which the difference between the y-coordinates is the same should belong to the same group".

[0017]

The fifth condition is that "when attention is paid to the y-coordinates of all fields, fields, in which the difference between the y-coordinates is large, should belong to different groups, and fields, in which the difference between the y-coordinates is small, should belong to the same group".

[0018]

The sixth condition is that if "the respective

differences between fields obtained by subtracting the x-coordinate at their respective front ends from the x-coordinate at their respective rear ends are the same or if the respective differences between fields in the x-direction are the same, they should belong to the same group".

[0019]

The seventh condition is that "the union of groups in the x-direction and groups in the y-direction is calculated, and fields belonging to the union should belong to the same group".

[0020]

Next, the rules on the movement of a boundary are described. The rules on the movement of a boundary located on the x-coordinate at the rear end of an arbitrary field include two rules. The first rule is that "if a boundary line is inside a group, the boundary should be moved to the x-coordinate of the boundary of the group". The second rule is that "if a boundary is located on the boundary of a group or outside a group, the boundary should not be moved".

[0021]

When of document is displayed across a plurality of display screens, a layout similar to a document is divided into a plurality of portions and is displayed

using the document analyzing means 28. The document analyzing means 28 comprises a document dividing means 22. The document dividing means 22 comprises four means; a means for vertically dividing a document (S1), a means for horizontally dividing a document (S2), a means for vertically and horizontally dividing a document (S3) and a means for determining optimal division (S4). An example of each means is shown below.

[0022]

Means S1 groups fields on the first condition, and calculates a temporary boundary. Furthermore, it groups fields in the y-direction on the third and fourth conditions. Then, it groups fields in the x-direction on the sixth condition. Lastly, it groups fields by calculating the union of field groups calculated on the third, fourth and sixth conditions. Then, by the boundary position determining unit 29 determining the positional relation between the boundary calculated on the first condition and a boundary indicating the group range of fields, based on the rules on the movement of a boundary and calculating the position of a boundary, a boundary candidate for vertically dividing a document.

[0023]

Means S2 groups fields by grouping fields in the y-direction on the third and fourth conditions, and

calculating the position of the y-coordinate of fields, the difference in the y-direction between which is large, in the calculated field group unlike other fields, on the fifth condition. The position of the y-coordinate thus calculated is the position candidate for a boundary for vertically dividing a document.

[0024]

Means S3 calculates a boundary candidate for vertically dividing a document using means S1. Then, it calculates a boundary for horizontally dividing a document using means S2. Furthermore, if all fields located in the lower section of the document by horizontally dividing the document cannot be accommodated on one display screen, grouping is again applied to the fields grouped in the lower section of the document by repeatedly using means S1 and S2. The respective boundaries calculated thus are the boundary candidates for vertically and horizontally dividing a document.

[0025]

Means S4 performs no process if none of the boundaries calculated by each means vertically or horizontally divide fields. If any of the boundaries vertically or horizontally divides fields or if the coordinates of the calculated boundary is larger than

the coordinates of each boundary indicating the display range of a display screen, it selects a boundary with the subsequent priority calculated by each means as a new boundary and finds a boundary neither vertically nor horizontally dividing fields.

[0026]

A display screen for a document, a piece of which is displayed across a plurality of display screens can be generated using boundaries calculated by the four means of the document analyzing means 28.

[0027]

Fig. 3 is a detailed flowchart showing the display position calculating process of calculating the display position on a display screen of each character of a document on the character reader in one preferred embodiment of the present invention.

[0028]

Next, the display position calculating process shown in Fig. 3 is described. Firstly, it is determined whether a document can be accommodated on one display screen (T1). If the determination is yes, a document layout is designated as a display layout, and the display position calculating process terminates. If the determination is no, it is determined whether the document can be accommodated in the y-direction of the

display screen (T2). If the determination is yes, it means that the document cannot be accommodated in the x-direction of the display screen. In this case, S1 and S2 of the document analyzing means 28 are applied, and the display position calculating process terminates (T3). If the determination is no, it is determined whether the document can be accommodated in the x-direction of the display screen (T4). If the determination is yes, S1 and S4 of the document analyzing means 28 are applied, and the display position calculating process terminates (T5). If the determination is no, S3 and S4 of the document analyzing means 28 are applied, and the display position calculating process terminates (T6).

[0029]

Next, the process of calculating boundaries indicating lines for dividing a document used to output each character of the document on a display screen as shown in Fig. 4 is described with reference to the flowchart of the display position calculating process. Fig. 4 shows the display position calculating process of the character reader in one preferred embodiment of the present invention and an example of a display screen outputted after the process. In Fig. 4, R1 represents the x-coordinate at the rear end of the relevant field

and P1 represents the x-coordinate at the front end of a right adjacent field whose y-coordinate is the same as the relevant field. Lines K and G represent boundaries for dividing a screen when outputting the characters of a document on a display screen. Fig. 4(1) shows the positions of boundaries that can be displayed on the conventional display screen.

[0030]

If each boundary indicating the dividing line of a document, used to generate a display screen is located as shown in Fig. 4(2), determination processes T1, T2 and T4 of the display position calculating process and S3 of the document analyzing means 28 (T6) are sequentially applied to each field.

[0031]

In S3, the entire first through seventh conditions except the second condition are used. Firstly, the temporary boundary K shown in Fig. 4(2) is calculated on the first condition. Then, the group of fields in the y-direction shown in Fig. 4(2) is calculated on the third and fourth conditions. Then, the group of fields in the x-direction shown in Fig. 4(2) is calculated on the sixth condition. Then, the union shown in Fig. 4(3) of the field groups calculated on the third, fourth and sixth conditions is calculated on the seventh condition.

The boundary position determining unit 29 determines whether the position of the temporary boundary K previously calculated on the first condition, in the field group indicating this union is optimal, based on the rules of movement of a boundary, and the correct position of the boundary is calculated. Then, a boundary G used to horizontally divide the field group calculated thus is calculated on the fifth condition. In this case, since the field groups located in the lower section of the document can be accommodated on one display screen, the process of S3 terminates. Then, it is determined whether each boundary calculated above meets S3 of the document analyzing means, and a boundary that meets S4 can be calculated. Each display screen shown in Fig. 4 can be automatically generated using each calculated boundary.

[0032]

This is different from the display on a display screen, using the conventional scrolling operation shown in Fig. 5. In this case, contents on a display screen can be easily collated with a document.

[0033]

Next, another means of the character display position calculating means 26 is described. In addition to the means for calculating the display position of

a field, the character display position calculating means 26 comprises a means for displaying related fields as much as possible on one screen or in one window if the display range is modified. The detailed process flowchart of this means is shown in Fig. 7. This means seeks blank to which a field can be displayed, and calculates the display position of the field in order to display related fields in the modified display range.

[0034]

Fig. 6 shows the display position of each field in the case where the window size of the display screen shown in Fig. 4 is modified. In Fig. 6, the vertical line on the right side of a window corresponds to the vertical boundary of a display range, and the horizontal line in the lower section of the window corresponds to the horizontal boundary of the window.

[0035]

Therefore, related fields can be displayed as much as possible in one window without modifying the size of characters belonging to the related fields, by the character position calculating means 26 shown in the flowchart of Fig. 7. Accordingly, even if a display screen is crowded with a variety of windows, the contents of read data can be easily checked in a little space. This is helpful when the window space of a display screen

must be efficiently used.

[0036]

The present invention is not limited to this preferred embodiment. Regardless of whether a document to be recognized is written horizontally or vertically, and whether a document can be displayed on one display screen or is displayed across a plurality of display screens, the document can be processed in the same way as this preferred embodiment.

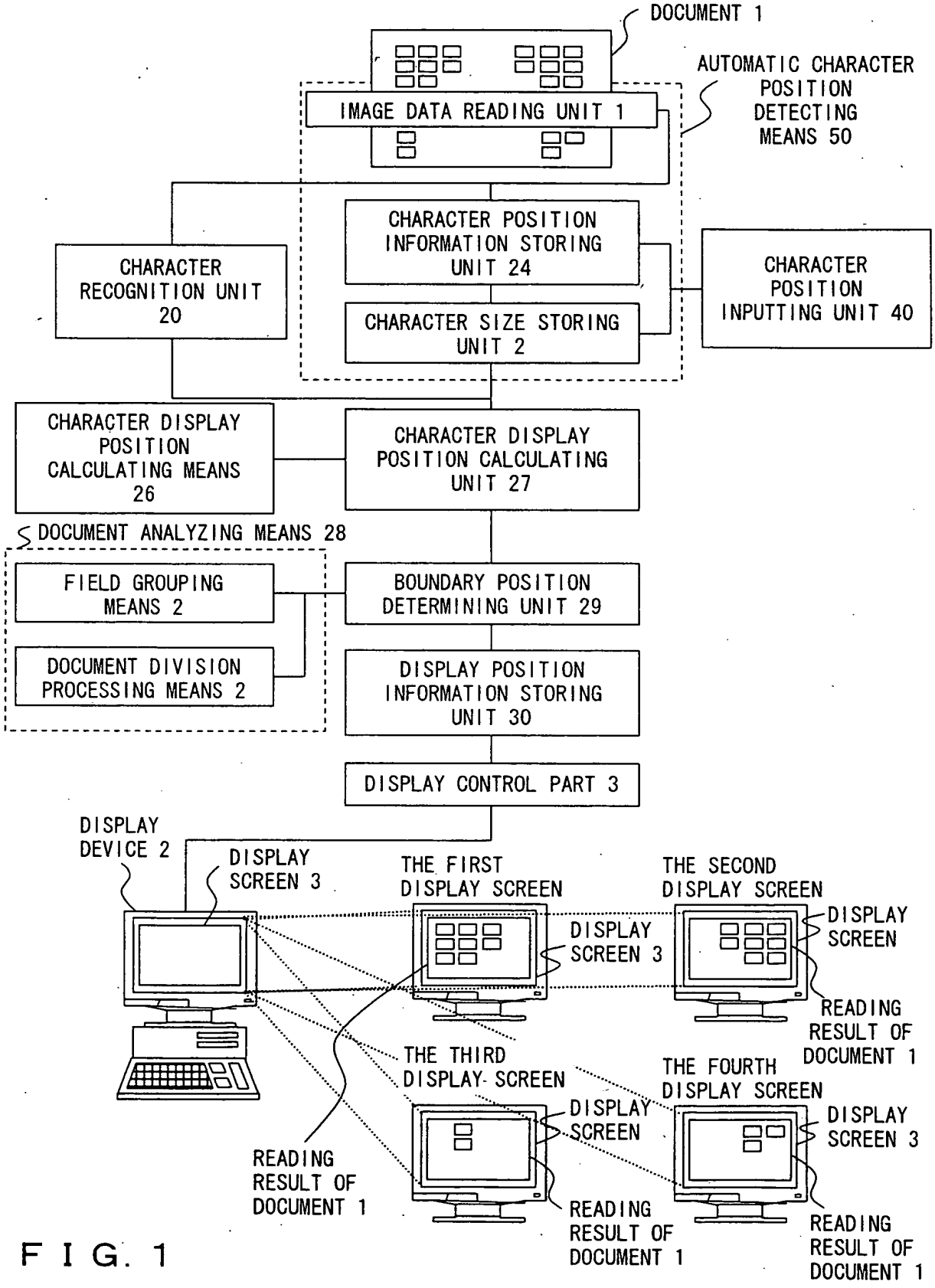
DOCUMENT 1
AUTOMATIC CHARACTER POSITION DETECTING MEANS 50
IMAGE DATA READING UNIT 1
CHARACTER RECOGNITION UNIT 20
CHARACTER POSITION INFORMATION STORING UNIT 24
CHARACTER SIZE STORING UNIT 2
CHARACTER POSITION INPUTTING UNIT 40
CHARACTER DISPLAY POSITION CALCULATING MEANS 26
CHARACTER DISPLAY POSITION CALCULATING UNIT 27
DOCUMENT ANALYZING MEANS 28
FIELD GROUPING MEANS 2
DOCUMENT DIVISION PROCESSING MEANS 2
BOUNDARY POSITION DETERMINING UNIT 29
DISPLAY POSITION INFORMATION STORING UNIT 30
DISPLAY CONTROL PART 3
DISPLAY DEVICE 2
DISPLAY SCREEN 3
THE FIRST DISPLAY SCREEN
THE SECOND DISPLAY SCREEN
DISPLAY SCREEN 3
DISPLAY SCREEN
READING RESULT OF DOCUMENT 1
THE THIRD DISPLAY SCREEN
THE FOURTH DISPLAY SCREEN
DISPLAY SCREEN
DISPLAY SCREEN 3
READING RESULT OF DOCUMENT 1
READING RESULT OF DOCUMENT 1
READING RESULT OF DOCUMENT 1

FIG. 1